

XII.—*On the Temperature of Deep Wells to the west of the Jumna.*

*By the Rev. R. EVEREST.*

During the last cold weather and the present, I have paid some attention to the temperature of wells in the country to the west of the Jumna. They are not usually more than 30 or 40 feet deep within a few miles of the river, but beyond Rhotak, about 50 miles to the west of this, on the road to Hansi, they are not less than 110 or 120 feet deep, and, in one instance I have met with (that of the fort at Hansi) 160 feet. Farther than that I cannot speak from examination, but all accounts agree in stating those in the Bikanir country to be the deepest, probably not less than 350 feet. I have almost invariably found the temperature to increase with the depth, but the increase is modified by three circumstances.

1st. By the locality, as in the case of a pool of water being near, or the mouth of the well being broad in proportion to its depth, both which causes tend to lower the temperature in the cold weather.

2ndly. By the season of the year at which the observation is made. The tendency of the rains is to reduce all wells to the uniform temperature of 78°, which is about that of the rain-water when it falls. From this cause the deep wells are at their minimum about the autumnal equinox, and get warmer during the cold weather. On the contrary, the more superficial ones become colder during the same period.

3rdly. By the quantity of water that is drawn from them. Those that are not used are usually the lowest, and those where oxen are working for the purpose of irrigation by a great deal the highest. I have only to premise further that the mean temperature of the year here, according to Major OLIVER's observations, is 76°. The general results I have obtained are as follows :

| No. of wells.  | Depth to bottom.     | Temperature at the bottom. |
|--|----------------------|----------------------------|
| 1. Mean of 10 observations made at nearly equidistant periods throughout the year, . . . . . | 42 . . . . .         | 78·6                       |
| 3 observations, . . . . .  | 60 . . . . .         | 79·2                       |
| 6 ditto, . . . . .   | 80 to 100 . . . . .  | 79·0                       |
| 5 ditto, . . . . .   | 110 to 120 . . . . . | 79·8                       |
| 1 ditto, . . . . .   | 160 . . . . .        | 80·0                       |

The increase in Europe is said to be 1° centigrade, or 1° 8 Farht. for every 35 or 37 metres (about 105 or 110 feet English), of depth. Were I to select from my observations those made where bullocks were working for the purposes of irrigation, the increase would be much more rapid than what I have above stated. Thus :

| No. of wells. | Depth to bottom. | Temperature. |
|---------------|------------------|--------------|
| 2 . . . . .   | 60 . . . . .     | 81           |
| 3 . . . . .   | 90 . . . . .     | 81·9         |
| 2 . . . . .   | 120 . . . . .    | 82·7         |

I do not publish these observations with the idea that they are sufficiently numerous to establish any general law on the subject for this country, but because my avocation here does not permit me to extend them, and in the hope that some one who may hereafter travel through the Bikanír country may be induced to take up the subject, for there alone can any considerable depth beneath the surface be attained.

P. S.—Lieutenant TREMENHEERE, of the Engineers, in leaving this on the Shekawatti campaign, had the kindness to promise that he would make some observations on the temperature of the deep wells that lay in his route, and this he has performed with great zeal and assiduity. He has now placed the results he obtained in my hands, and I have drawn up the following abstract of them :

| No. of Wells<br>observed. | Depth.          | Aver. Temp. |
|---------------------------|-----------------|-------------|
| 13....                    | 40 to 80 feet.  | 78°         |
| 6....                     | 80 to 120 ....  | 79° 4       |
| 4....                     | 120 to 140 .... | 81°         |

These observations were made throughout a large tract of country lying between 28 and 26° N. Lat. and 78 to 76° E. Long. And the time of the year in which they were made was from the 26th October to the 28th February. The mean temperature of the year for the surface may be reckoned at 75°, if, as stated by Lieut.-Col. OLIVER, that of Dehli be 73°. 4.

I see that in the above paper on this subject I have misquoted this same datum of Colonel OLIVER's, calling it 76°. I took the number carelessly from the wrong column, owing to its suiting so well to Dr. ROYLE's observations at Seháranpur, who makes the mean of that place, I believe, 73°. 5. One or other of the two observations must now be rejected.

XIII.—Abstracts of a Meteorological Register kept at "Caineville,"

Musoorée (Masúri.) By S. M. BOULDERSON, Esq.

| 1834.                    |   | Bar.                                   | attd.     | Therm. | detd. |
|--------------------------|---|--|-----------|--------|-------|
| From 15th to end of May, | 8 observations at 10 A. M.                | 23.919                                 | 75        | 78.1*  |       |
|                          | 9 " " " at 4 P. M.                        | 23.894                                 | 75.6      | 79.5*  |       |
|                          | 10 " " " at 10 P. M.                      | 23.905                                 | 74.8      | 75.7   |       |
|                          | Mean temperature at 10 A. M. and 10 P. M. | 76°9.                                  |           |        |       |
|                          | Bar. at 4 P. M. compared with 10 A. M.    | Bar. at 4 P. M. compared with 10 P. M. |           |        |       |
|                          | Mean diff. greatest. least.               | Mean diff.                             | greatest. | least. |       |
| (6 obsrs.)               | —0.043 —0.060 —0.026                      | (7 obsrs.)                             | —0.034    | —0.066 | 0.004 |
|                          |   |  | Therm.    |        |       |
|                          |   | Bar.                                   | attd.     | Therm. | detd. |
| June,.....               | 25 observations at 10 A. M.               | 23.897                                 | 71.8      | 70.3   |       |
|                          | 22 " " " at 4 P. M.                       | 23.815                                 | 71.4      | 71.1   |       |
|                          | 23 " " " at 10 P. M.                      | 23.870                                 | 71.5      | 68.0   |       |

\* I think that the temperature at 10 A. M. and 4 P. M. was considerably raised by reflection. This was modified or obviated in the subsequent months.